Top Finger Having A Groove And Semiconductor Device Having The Same

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention generally relates to a semiconductor device, and more particularly to a surface mount semiconductor device with a structure that includes a groove to prevent solder overflow.

Description of the Related Art

[0002] Figure 1 illustrates a semiconductor device manufactured according to a conventional soldering process. A die (12) is attached on a lead frame (10) and then a top finger or clip (11) is attached on the die (12). For a pre-bump or solder paste process of a clip design device, it is easy to find a potential failure occurring on the top side of the die (12). The potential failure is frequently caused by solder (14) overflowing onto a passivation ring (13). Such an overflow will increase the stress on the passivation ring (13) thereby causing a higher leakage or a potential reliability problem.

[0003] There are many known ways to prevent solder from overflowing onto the passivation ring. One way is to increase the distance between the top finger and the die so as to increase the dimple height. However, this method will also increase the mechanical stress on the die and deteriorate soldering quality as well. Another way is to reduce the solder volume to prevent the solder from overflowing onto the passivation ring. However, such a way will increase the forward voltage as well.

SUMMARY OF THE INVENTION

[0004] A lead frame having a top finger and a semiconductor device having the same are disclosed. The top finger includes a groove and the groove is provided at the bottom

side of the top finger and adjacent to the contact position between the top finger and a die, so as to prevent solder from overflowing onto a chip passivation ring, reducing the stress on the die and increasing the reliability.

[0005] Preferably, the groove of the top finger is a U or V-groove.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] For a more complete understanding of the present invention and the advantages thereof, reference is now made to the following descriptions taken in conjunction with the accompanying drawings which illustrate the embodiments of the present invention, wherein:

[0007] Figure 1 illustrates a cross-sectional view of a semiconductor device manufactured according to a conventional soldering process;

[0008] Figure 2 illustrates a cross-sectional view of a semiconductor device manufactured according to one embodiment of a lead frame in accordance with the present invention; and

[0009] Figure 3 illustrates a top view of one embodiment of a lead frame in accordance with the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0010] Figure 2 illustrates a surface mount semiconductor device, such as a rectifier, manufactured according to an embodiment of the present invention. The semiconductor device comprises a bottom lead frame (20); a die (22) attached on the bottom lead frame (20); a top finger or clip (21) having a groove (25), such as a U or V-groove, attached on the die (22) by a conductive material (24), such as solder; and a molding compound (26) for molding the semiconductor device. The groove (25) is provided at a bottom side of the top finger (21) and is adjacent to the contact position between the top finger (21) and the die (22) so as to prevent the solder (24) from overflowing onto a chip passivation ring (23), thereby reducing the stress on the die (22) and increasing the reliability.

[0011] Figure 3 illustrates one embodiment of a lead frame of the present invention implemented in a folded frame type approach. The lead frame can be used in the semiconductor device as shown in Figure 2. The lead frame comprises a finger portion (31),

such as a top finger or clip, having a groove (35), such as a U or V-groove shown in Fig. 2; and a die-attached portion (30) for attaching a die thereon. The groove (35) is provided at the bottom side of the finger portion (31) and adjacent to the contact position between the finger portion (31) and the die so as to prevent a solder from overflowing onto a chip passivation ring, reduce the stress on the die and increase the reliability.

[0012] Although the present invention and its advantage have been described in detail, it should be understood that various changes, substitutions and alternations can be made herein without departing from the spirit and scope of the invention as defined by the appended claims.